CLAIMS

What is claimed is:

1. A system for injecting spin-based electrons into silicon, comprising:

a ferromagnetic metal contact capable of transmitting carriers having a primary spin polarization; and

a silicide layer positioned between the ferromagnetic metal contact and the silicon, the silicide layer making ohmic contact with the silicon such that the spin-polarized carriers transmitted from the ferromagnetic metal contact can be injected into the silicon without altering the primary spin polarization.

2. A system according to claim 1, further comprising:

a silicon substrate, the silicide layer being disposed on a surface of the silicon substrate and acting as a tunneling junction between the ferromagnetic metal contact and the silicon substrate.

3. A system according to claim 1, wherein:

the ferromagnetic metal contact and silicide layer form a source electrode.

4. A system according to claim 1, further comprising:

a drain electrode contacting the silicon, the drain electrode including a ferromagnetic detection contact capable of receiving the spin-polarized carriers, and further including a second silicide layer disposed between the ferromagnetic detection contact and the silicon substrate such that the spin-polarized carriers flowing into the ferromagnetic detection contact from the silicon substrate maintain spin polarization.

5. A system according to claim 1, further comprising:

a gate electrode positioned on the silicon substrate, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate such that spin-injected carriers flowing through the electric field tend to change spin orientation.

6. A system according to claim 1, further comprising:

an external field generator capable of applying an electric field across the silicon such that spin-injected carriers flowing through the electric field tend to change spin orientation.

7. A system according to claim 1, further comprising:

a nanowire polygate positioned adjacent the silicon and capable of applying a magnetic field across the silicon such that spin-injected carriers flowing through the electric field tend to change spin orientation.

8. A system according to claim1, wherein:

the silicide layer is a cobalt silicide layer.

9. A system according to claim 1, wherein:

the silicide layer is a nickel silicide layer.

10. A system according to claim 1, wherein:

the ferromagnetic metal contact is a cobalt ferromagnetic metal contact.

11. A system according to claim 1, wherein:

the ferromagnetic metal contact is a cobalt ferromagnetic metal contact.

12. A spin-based transistor, comprising:

a silicon substrate;

a source electrode on the silicon substrate, the source electrode including a ferromagnetic injection contact capable of injecting spin-polarized carriers into the silicon substrate, and further including a first silicide layer disposed between the ferromagnetic injection contact and the silicon substrate such that carriers injected into the silicon substrate maintain spin polarization;

a drain electrode on the silicon substrate, the drain electrode including a ferromagnetic detection contact capable of receiving spin-polarized carriers, and further including a second silicide layer disposed between the ferromagnetic detection contact and the silicon substrate such that carriers flowing into the ferromagnetic detection contact from the silicon substrate maintain spin polarization; and

a gate electrode positioned on the silicon substrate between the source electrode and gate electrode, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate between the source and gate electrodes such that carriers flowing through the electric field will change spin orientation.

13. A method for forming a contact for a spin-based device, comprising:

depositing a first ferromagnetic metal layer on a silicon substrate;

annealing the first ferromagnetic metal layer to form a layer of metal silicide, the layer of metal silicide having a thickness allowing the layer to act as a tunneling junction for spin-polarized carriers; and

forming a second ferromagnetic layer on the layer of metal silicide, the second ferromagnetic layer operable as a ferromagnetic contact capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

14. A method according to claim 13, wherein:

annealing the ferromagnetic metal layer to form a layer of metal silicide includes annealing a first portion of the first ferromagnetic metal layer, the metal silicide being in contact with the silicon layer, and

forming a second ferromagnetic layer includes not annealing a second portion of the first ferromagnetic layer in order to form a ferromagnetic metal contact, the ferromagnetic metal contact overlying the layer of metal silicide and capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

15. A method according to claim 13, wherein:

forming a second ferromagnetic layer includes depositing a second ferromagnetic metal layer on the layer of metal silicide, the second ferromagnetic layer operable as a ferromagnetic contact capable of injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate without loss of spin polarization.

16. method according to claim 13, further comprising:

etching the layer of metal silicide to remove any unnecessary metal silicide.

17. method according to claim 13, further comprising:

applying a magnetic field to the second ferromagnetic layer in order to control the spin-polarization of the second ferromagnetic layer.

18. method according to claim 13, wherein:

annealing the first ferromagnetic metal layer to form a layer of metal silicide and forming a second ferromagnetic layer on the layer of metal silicide forms a source electrode for injecting spin-polarized carriers through the layer of metal silicide into the silicon substrate.

19. method according to claim 13, wherein:

annealing the first ferromagnetic metal layer to form a layer of metal silicide and forming a second ferromagnetic layer on the layer of metal silicide forms a drain electrode for receiving spin-polarized carriers from the silicon substrate through the layer of metal silicide.

20. method according to claim 13, further comprising:

depositing a gate electrode on the silicon substrate, the gate electrode capable of receiving a gate bias and applying an electric field across the silicon substrate such that spin-polarized carriers flowing through the electric field will change spin orientation.